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PATENTED NOV. 1, 1904.

L. E. BARBE.

PROCESS OF DRY CLEANING GARMENTS.

APPLICATION FILED DEC. 30, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

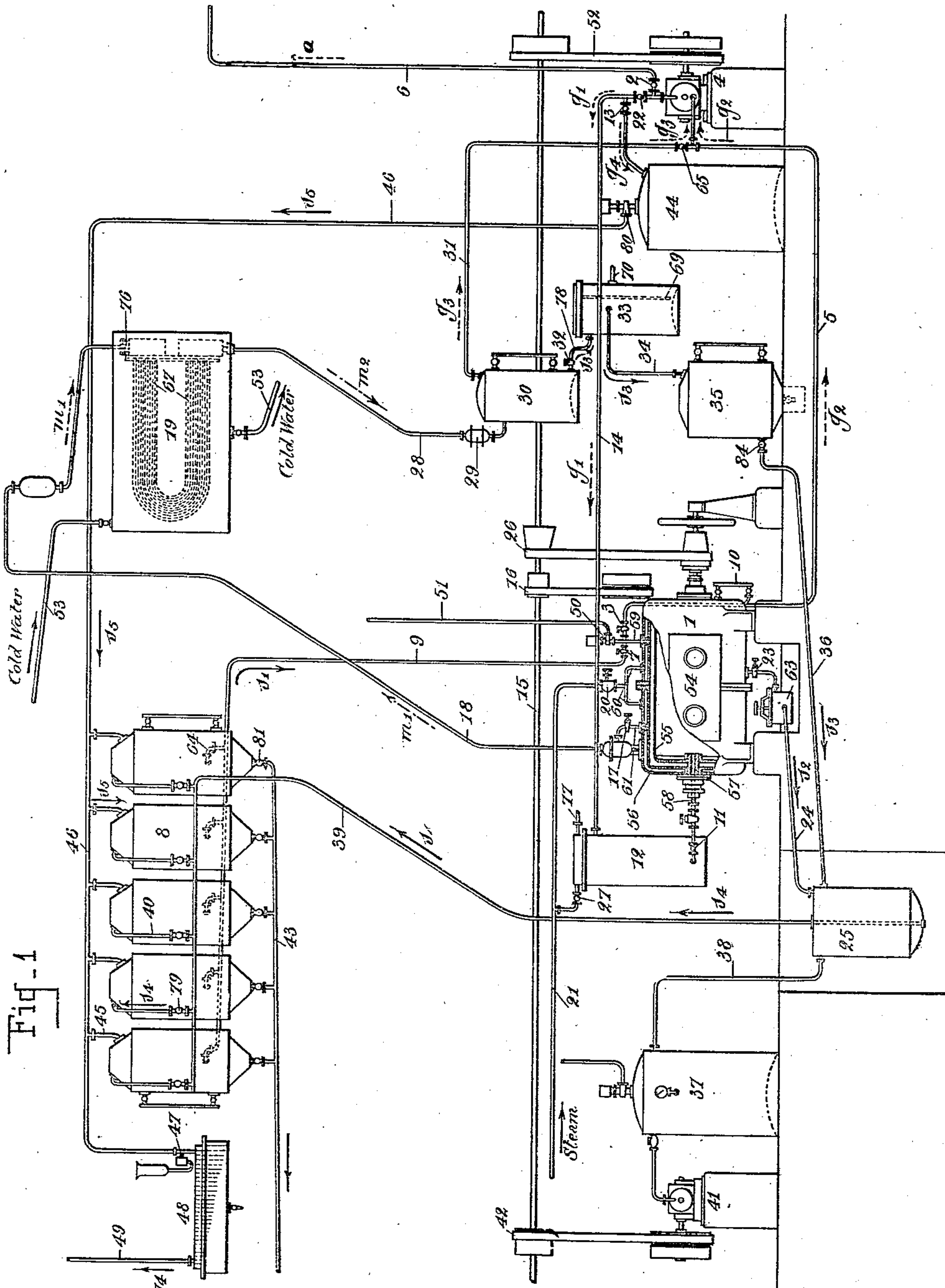


Fig. 1

Witnesses

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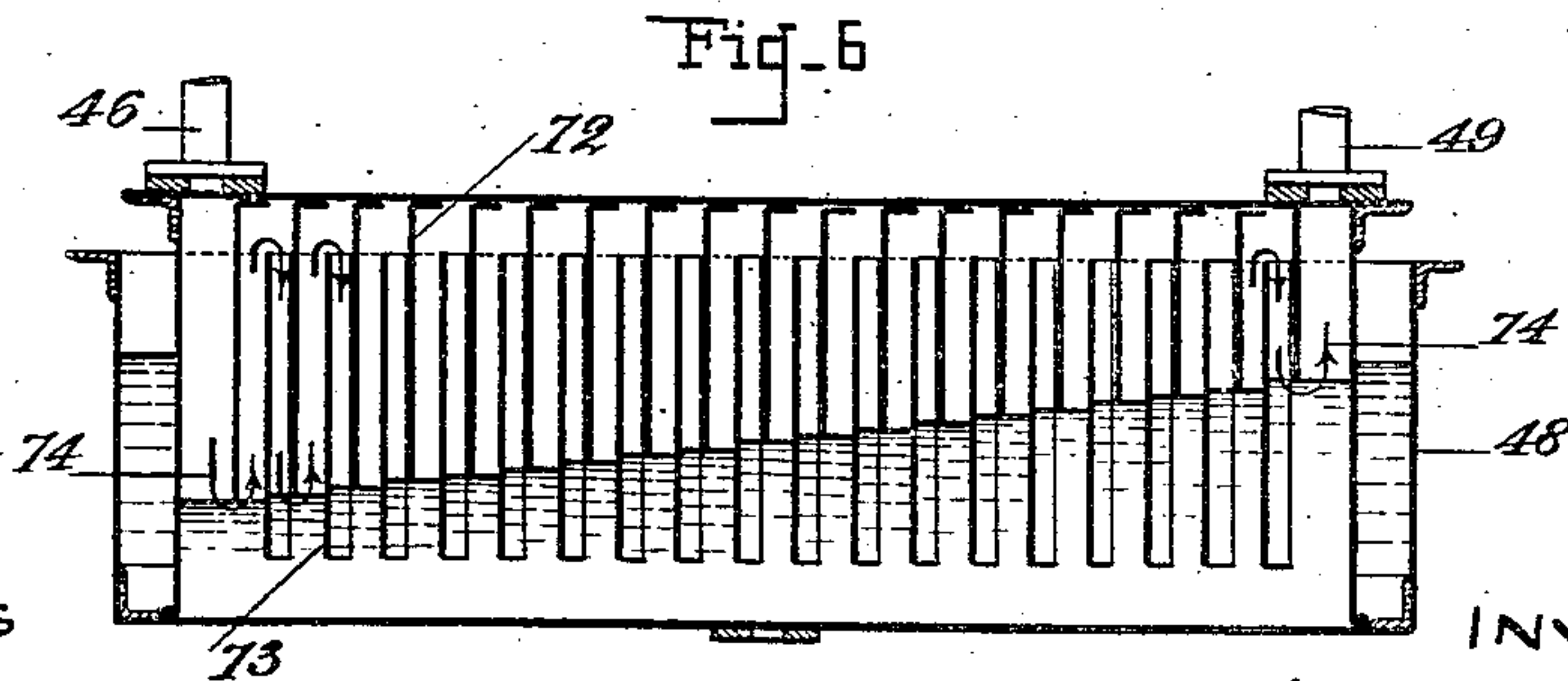
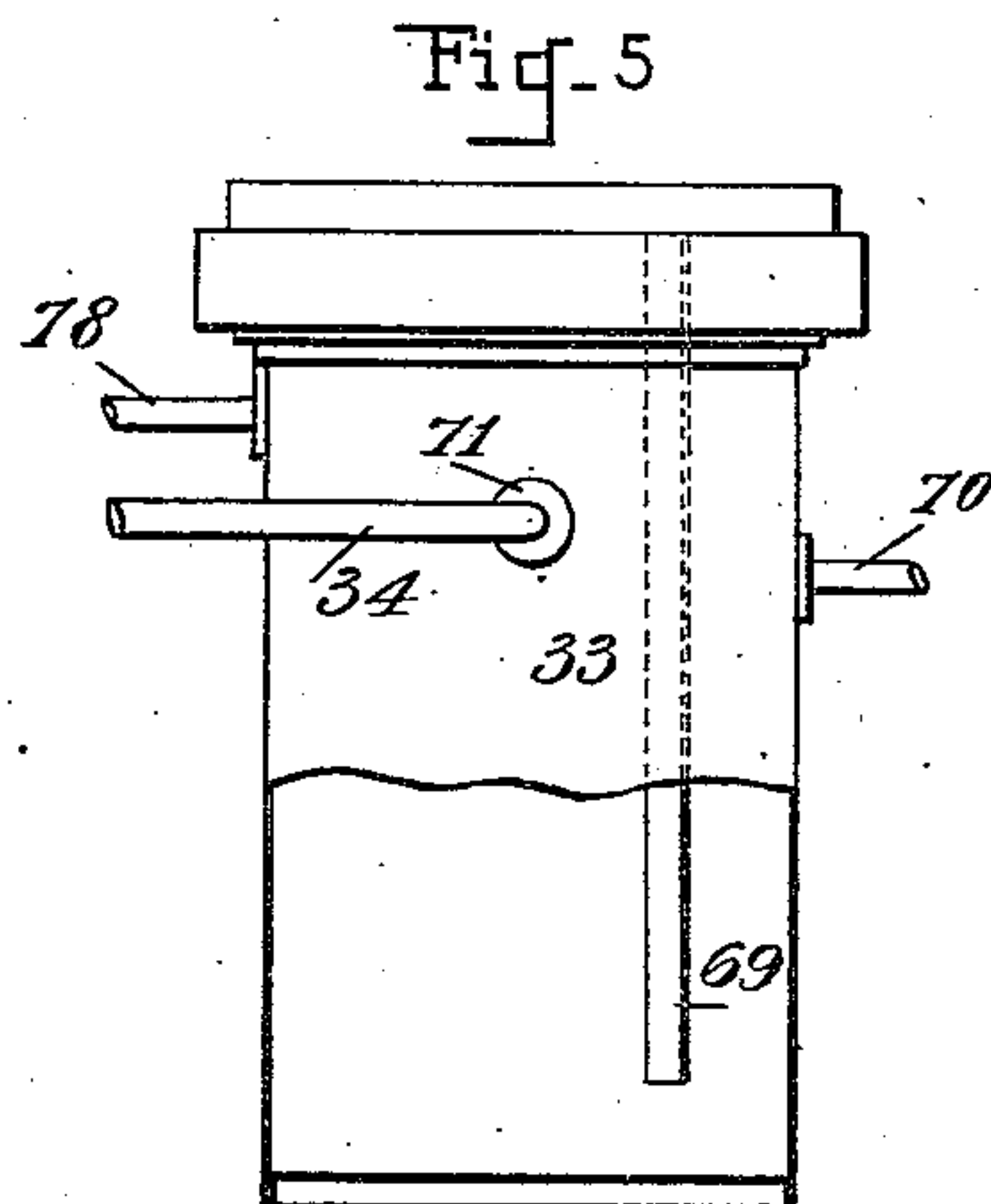
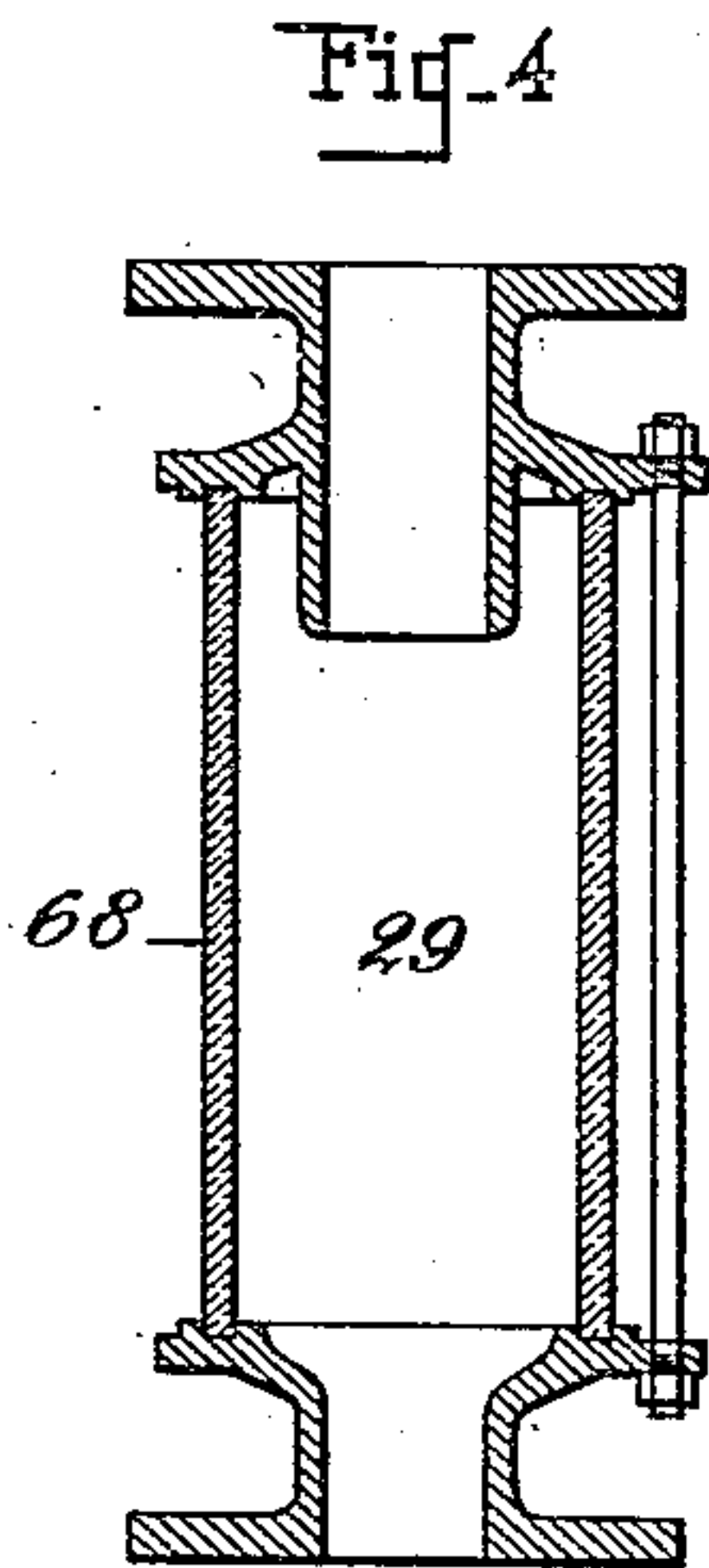
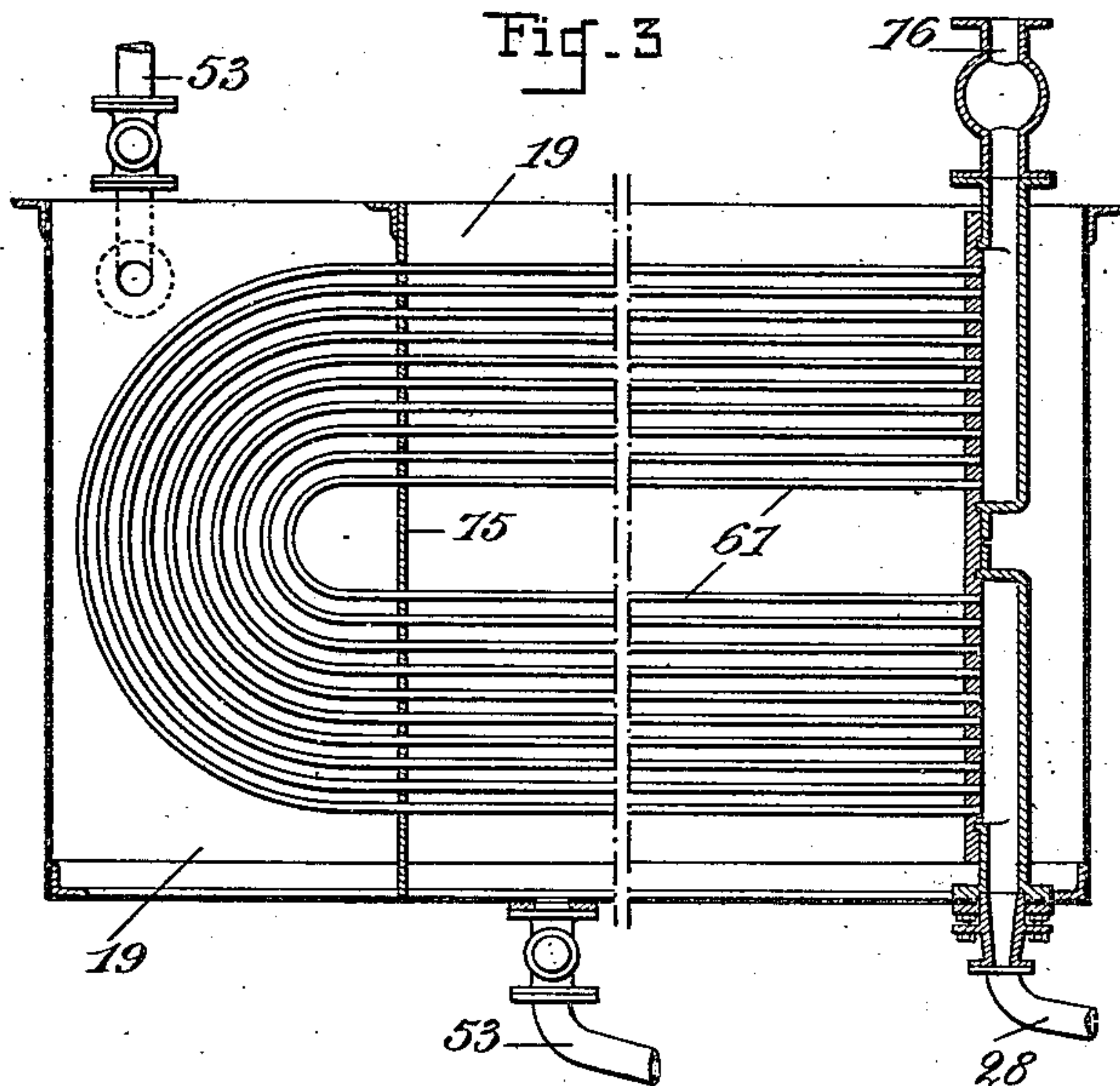
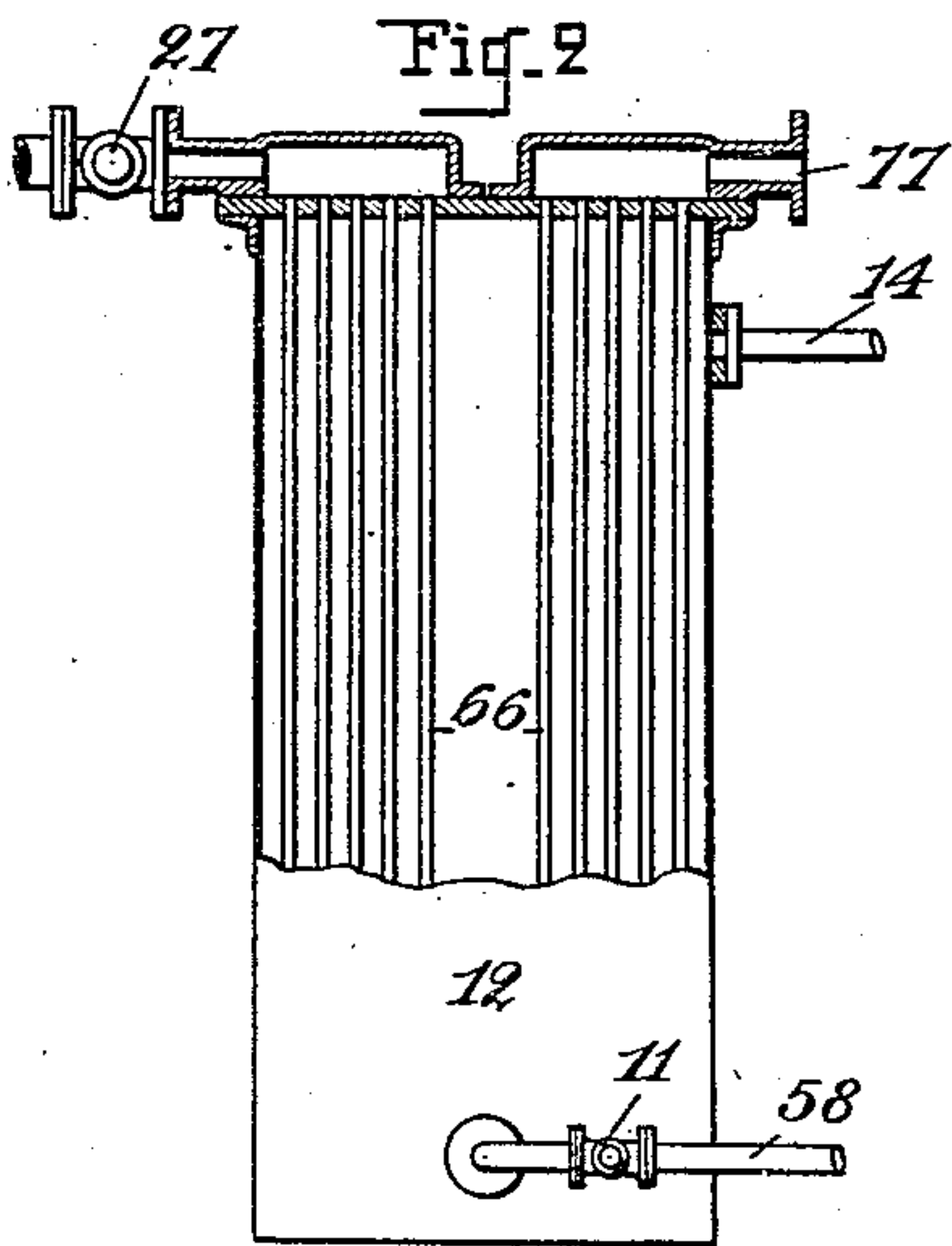
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2 SHEETS—SHEET 2.



WITNESSES

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# UNITED STATES PATENT OFFICE.

LOUIS ETIENNE BARBE, OF PARIS, FRANCE.

## PROCESS OF DRY-CLEANING GARMENTS.

SPECIFICATION forming part of Letters Patent No. 774,025, dated November 1, 1904.

Application filed December 30, 1902. Serial No. 137,162. (No specimens.)

*To all whom it may concern:*

Be it known that I, LOUIS ETIENNE BARBE, a citizen of the French Republic, residing at Paris, in the Republic of France, (whose full postal address is 18 Rue Mogador, Paris, aforesaid,) have invented a certain new and useful Process for Dry-Cleaning and Disinfection of Clothes by Means of Volatile Solvent, (for which I have obtained a patent in France, No. 321,542, bearing date June 4, 1902, and in Great Britain, No. 17,397, August 7, 1902,) of which the following is a specification.

This invention has for its object an improved process of dry-cleaning garments, clothes, &c., by means of volatile solvent, the said process insuring on the one side the rapid and perfect treatment of the objects to be cleaned and on the other side the complete recuperation of the chemical agent employed for the said treatment.

This process consists in subjecting garments to action of solvent in a hermetically-closed apparatus continually rotated and heated, through which at the same time a continuous circulation of inert gas is effected; in discharging the dirty solvent and in drying it from the garments before each change of solvent-baths; in recuperating by distillation, condensation, and decantation residual solvent retained on the garments, and in storing the whole of the liquid solvent thus removed from the cleaning apparatus in closed vessels under action of inert gas; in recuperating the said inert gas, separating it from solvent vapors mixed therewith, and storing the said inert gas, which circulates according to a perfectly-closed circle without communication with the atmosphere.

The carrying out of my process will be fully described in the following specification, with reference to the accompanying drawings, which represent, as an example—

Figure 1, the diagrammatic view of a general instalment adapted to carry out my process; Figs. 2, 3, 4, 5, and 6, detail views of several devices included in the instalment shown in Fig. 1.

Referring to Fig. 1, 1 is a cleaning apparatus, preferably of the kind which forms the object of my United States Patent No.

757,011, provided with a jacketed casing 56 and with an inner perforated cylinder 55, the latter being adapted to receive on the axis 57 either a slow oscillating motion or a rapid continuous rotation imparted to it, respectively, by means of transmissions 16 and 26, directly operated by the main shaft 15. Man-hole 54 enables introducing objects to be treated into the apparatus 1, which is connected with the following devices:

The apparatus 1 is connected by means of pipes 64 and 9, cocks 7, and pipe 59 with reservoirs 8, containing the chemical agent or solvent employed in the operations.

The apparatus 1 is connected by means of pipe 58 (crossing the axis 57, which is hollow at this end) and cock 11 with a vessel 12, adapted to work as a heater. For this purpose the said vessel is provided with a tubular system 66, Fig. 2, in which may enter steam coming through pipe 21 and cock 27, the said steam escaping outwardly through tubulure 77. The stove 12 is connected with a reservoir 44 by means of pipe 14 and cock 13, and the pipe 14 communicates with a pump 4 by means of a cock 22, the said pump being itself connected with the apparatus 1 by means of pipe 5, cock 3, and pipe 59 and being operated by means of transmission 52.

The apparatus 1 is connected by means of cock 23, filter 63, and pipe 24 with a collector-receiver 25, having for its purpose to collect the liquid solvent (chemical agent) at the end of a cleaning operation.

The apparatus 1 is connected by means of pipe 61, cock 17, pipe 18, and tubulure 76 with the tubular system 67 of a refrigerator 19, having for its purpose to condense the solvent vapors exhausted from the apparatus 1. A suitable circulation of cold water through the said refrigerator is insured by means of pipes 53 53. Lastly, the jacketed casing 56 of the apparatus 1 may be heated by means of steam coming from pipe 21 through cock 20 and pipes 60 60, and, furthermore, the inner space of the said apparatus may communicate with the atmosphere through a valved coupling 50, joining the pipes 59 and 51.

The general instalment shown in Fig. 1 includes between its several elements the fol-



lowing connections: The reservoirs 8 are connected on the one side with the receiver 25 by means of pipes 40, cocks 79, and pipe 39 and on the other side with the reservoir 44 by means of pipes 45 46 and cock 80. The end of the pipe 46 enters the extremity of a purifier 48, Fig. 6, with baffle-plates 72 73, which is half-filled with a very good solvent of the chemical agent employed for the cleaning in such a manner that the gases before escaping outwardly cross the purifier, following the way indicated by the arrows 74. Thus the gases escaping into atmosphere through pipe 49 are completely free from vapors of the chemical agent employed for the cleaning. Lastly, the bottom of the reservoirs 8 is connected by means of cock 81 with a pipe 43, having for its purpose to conduct the solvent when it has become too dirty to be utilized toward any purifier apparatus. (Not shown in the drawings, because it forms no part of the invention.)

The receiver 25 communicates by means of a pipe 38 with a receptacle 37, in which air may be compressed by means of a pump 41, actuated by transmission 42. On the other side the receiver 25 is joined by means of pipe 36 and cock 84 to a receiver 35, having for its purpose to collect the chemical agent condensed in the refrigerator 19, the latter being itself connected with the receiver 35 through the medium of the following apparatus: The tubular system 67 of the refrigerator 19 communicates with a pipe 28, entering the top of any controlling device 29, the glass 68 of which, Fig. 4, permits the operator to watch the condensing operation. The bottom of the device 29 is joined to a separator vessel 30, which is connected on the one side with the pump 4 by means of pipe 31 and cock 65 and on the other side with a Florentine vessel 33 by means of cock 32 and pipe 78. The said Florentine vessel, Fig. 5, has for its purpose to separate the water from condensed chemical agent, (solvent,) the latter escaping through the tubulure 71 and the pipe 34 to fall into the receiver 35, whereas the water passing under the wall 69 escapes outwardly through the pipe 70.

Having thus described, as an example, a general instalment suitable to carry out my improved process, I will describe now, step by step, the carrying out of the said process.

*I. Charging the cleaning apparatus.*—The whole of the cocks on the apparatus 1 are closed, the manhole 54 is opened, the garments, clothes, or objects to be treated are introduced into the inner cylinder 55, after having been previously freed from all moisture and dust, and the manhole 54 is then hermetically closed. The air contained in the apparatus 1 is then drawn out, and for this purpose the cocks 3 and 2 are opened, the pump 4 is put in action, and the air exhausted from the apparatus 1 is rejected through the pipe 6, following the

way indicated by the arrow *a*. When the vacuum is produced in the apparatus 1, the cock 3 is closed, the pump 4 is put out of action, and the cock 2 is closed. The chemical agent (solvent) is then introduced into the apparatus 1. For this purpose the cock 7 is opened and the solvent flows through the pipe 9, following the way indicated by the arrow *s'*. The transferring of the said solvent is effected only by the action of gravity, as the level of the reservoirs 8 is higher than that of apparatus 1, thus doing away with the expense for motive power. When the level indicated by the gage 10 has risen to the desired height, the cock 7 is closed. The apparatus 1 is then filled with inert gas. For this purpose the cocks 13 and 11 are opened and the gas under pressure contained in the reservoir 44 flows through the pipe 14, the vessel 12, the cock 11, and the pipe 58, following the way indicated by the arrows *g'*. As soon as the pressure in the apparatus 1 has become equal to the atmospheric pressure the cocks 11 and 13 are closed and the apparatus is ready for the operation of the cleaning.

*II. Cleaning or disinfecting the objects.*—

The transmission 16 is put in action, imparting then a slow oscillating motion to the cylinder 55, and insuring thus the regular action of the solvent on all the parts of the objects treated at the same time. Furthermore, the rapidity of the said action and its full effect are insured by the heating of the apparatus 1. For this purpose the cock 20 is opened and steam is introduced into the jacketed casing 56. In order to prevent a too great increase of pressure in the apparatus 1, resulting of the heating of the vapors therein, the cocks 11, 3, and 22 are opened and the pump 4 is put in action, whereby the circulation of inert gas and solvent vapors is effected (following the arrows *g' g''*) through the apparatus 1. Furthermore, the cock 17 is opened, whereby the inside of the apparatus 1 is made to communicate with the refrigerator 19 through the pipe 18.

*III. Recuperating the solvent employed in the cleaning.*—When the cleaning is ended, the cock 23 is opened and the liquid solvent flows, following the way indicated by the arrow *s''* into the receiver 25. When this discharge is ended, the transmission 26 is put in action in order to impart to the cylinder 55 a rapid rotary motion, and exhausting thus by drying the liquid solvent retained on the objects. Whereas the cleaning may include the use of several solvent-baths, it will effect in this case before each change of baths the discharge of the liquid solvent by means of the aforesaid two operations. Lastly, after the last change of baths the complete recuperation of the solvent is insured as follows: The cocks 23 and 3 are closed, and the cock 65 is opened. The cock 27 is opened to admit the heating-steam into the stove 12 without



interrupting the heating of the apparatus 1, and the pump 4 is put in action. By this means a circulation of hot inert gas is effected through the apparatus, following the way indicated by the arrows  $g' m' m^2 g^3$ . This continuous circulation of inert gas, constantly reheated before it reenters into the apparatus 1, effects the distillation of the solvent retained on the objects treated, and the vapors thus generated pass, together with the inert gas, to the refrigerator 19, in which they are condensed, and fall into the separator after having passed the controlling device 29. The inert gas is separated from the liquid solvent in the said separator, and drawn out through the pipe 31 by the pump 4 it reenters in the circulation above mentioned. During the whole of this operation the exhaust is maintained only to extent of a few centimeters, as the gas drawn off at each stroke of pump, following the way indicated by the arrows  $m', m^2$ , and  $g^3$ , is replaced in the apparatus 1 by the gas forced back from the pump 4, following the way indicated by the arrows  $g'$ .

IV. *Recuperating the inert gas employed in the recuperation of the solvent.*—When the controlling device 29 has indicated the end of the condensation effected in the refrigerator 19, the cocks 11, 20, 27, and 65 are closed and the cock 13 is opened. The pump 4 is continued in action, so as to draw the inert gas from the apparatus 1, following the way indicated by the arrows  $m', m^2, g^3$ , and  $g^4$  and to force the said gas into the reservoir 44. The apparatus 1 is thus again completely exhausted and the said exhausting is made very rapid by this fact, that during the said operation the said apparatus continues to be rotated and heated.

V. *Removing the cleaned objects.*—For the purpose of removing the cleaned objects the cocks 17 and 13 are closed, the pump 4 is stopped, and the cock 50 is opened, what enables to open the manhole 54 and the objects contained in the apparatus 1 to be removed.

VI. *Storing the solvent employed and recuperated.*—It will be seen from the above description that the solvent is now collected in several two vessels—viz., receiver 25 and separator 30. First, the solvent contained in the separator 30 is conveyed into the receiver 25, following the way indicated by the arrows  $s^3$ . For this purpose the cock 32 is opened, the separator 30 is emptied into the Florentine vessel 33, and thence into the reservoir 35. It may be advantageous to collect into the reservoir 35 the solvent recuperated by distillation (coming from several cleanings) when the quantity produced by only one cleaning is too little. When the quantity of solvent collected in the said reservoir is become sufficient, the cock 84 is then opened and the solvent falls into the receiver 25, so that finally the solvent is collected in the said single vessel from which it is stored into the reservoirs

8 in the following manner: After having compressed in the receptacle 37 a sufficient quantity of air by means of the pump 41 the cock 84 is closed and communication is established between the receptacle 37 and the receiver 25. The solvent is forced by the compressed air into the reservoirs 8, following the way indicated by the arrows  $s^4$ . The small quantity of solvent vapors which could be carried out by the air discharged to the outside through the pipes 45 and 46 is retained by the purifier with baffle-plates 48, which is half-filled with a very good solvent of the chemical agent employed for the cleaning. If benzene, petroleum-essence, carbon-tetrachlorid are employed, the best solvent for this purpose is oil. When the air escapes outwardly through the pipe 49, it is entirely free from all traces of vapors of the chemical agent employed, (solvent.) Lastly, in the case where the inert gas collected into the reservoir 44 could draw with it some solvent vapors, which are then condensed therein, the said solvent is stored in the same manner as described in the case of the receiver 25; but the inert gas compressed in 44 is employed instead of air. The solvent follows the way indicated by the arrows  $s^5$ , fall into the reservoirs 8, whereas the inert gas is caused before being expelled to the outside to pass through the purifier 48.

In short, it will be seen from the above specification that, first, the solvent employed is completely recuperated, whereas coming from the reservoirs 8 it is entirely reintroduced in the latter, either after having followed in state of liquid the closed cycle indicated by the arrows  $s' s^2 s^4$  or in state of vapor and of liquid the closed cycle indicated by the arrows  $s' m' m^2 s^3 s^4$ , or, finally, in state of vapor and of liquid the closed cycle indicated by the arrows  $s' m' m^2 g^3 g^4 s^5$ ; second, the inert gas employed is completely recuperated, whereas coming from the reservoir 44 it is entirely recharged in the latter, as it travels either the closed cycle indicated by the arrows  $g' g^2$  without at any time being put in connection with the atmosphere or the closed cycle indicated by the arrows  $g' m' m^2 g^3 g^4$ . In this manner any traces of solvent vapors which may resist the action of the refrigerator 19 will be condensed in the reservoir 44 and recuperated in the manner above specified, so that the recuperation of the solvent employed for the cleaning is effectively absolutely perfect.

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim—

1. A process of dry-cleaning and disinfecting garments by means of volatile solvent, with recuperating the whole of the latter; the said process consisting in subjecting garments to action of solvent in a hermetically-closed



apparatus continually rotated and heated, through which, at the same time, a continuous circulation of inert gas is effected; in discharging the dirty solvent and in drying the garments before each change of solvent-baths; in recuperating, by distillation condensation and decantation, residual solvent retained on the garments and in storing the whole of the liquid solvent thus removed from the cleaning apparatus in closed vessels under action of inert gas; in recuperating the said inert gas, separating it from solvent vapors mixed with, and storing the said inert gas which circulates according to a perfectly-closed cycle without communication with the atmosphere; substantially as described.

2. In a process of dry-cleaning and disinfecting garments by means of volatile solvent with recuperating the whole of the latter, the method which consists in discharging the dirty solvent remaining liquid in the cleaning apparatus, in drying that retained on the garments which are continuously heated, and in collecting, before each change of solvent-bath, both quantities of liquid solvent thus removed; removing, at the end of cleaning, the residual solvent retained in the garments, by distilling

it under action of continuous circulation of inert gas passing, hot and under a very slight pressure following a closed cycle, through the garments continuously rotated and heated; in condensing the solvent thus evaporated, separating it from the inert gas and reheating the latter before it reenters into the cleaning apparatus; in collecting together with dirty solvent previously discharged in liquid state from the cleaning apparatus, the solvent thus recuperated, and in storing the whole thus collected by forcing it to pass, under action of compressed air, into reservoirs established at a level higher than that of the cleaning apparatus, the compressed air employed for this storing being forced, before it escapes to pass through a purifier with baffle-plates which is half filled with a very good solvent of the chemical agent used for the cleaning; substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

LOUIS ETIENNE BARBE.

Witnesses:

PHILEBUS COBER ROBÉKEL,  
JULES FAYOLLET.